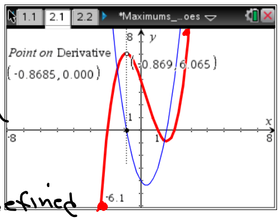
4.1 Extreme values of functions

local vs global extreme values



if f has a max/min

then f' might be 0

or f' might be undefined

but for sure, f' changes sign

critical points, endpoints — candidate list for extrema

$f'=0$

or f' ∗

Oct 18-8:47 AM

find extrema of f(x) on [-2,3]. Solve graphically and analytically

max, min

Define $f1(x)=x^{\frac{2}{3}}$ Done

$f' = \frac{2}{3}x^{-\frac{1}{3}} = 0$

$f' = \frac{2}{3\sqrt[3]{x}} = 0$

candidate list (where)

1. $f'=0$ never — min at $x=0$
2. $f'=$ ∗ $x=0$
3. endpoints $x=-2$, $x=3$

what

$f(0) = 0 =$ min

$f(-2) = (-2)^{2/3} = \sqrt[3]{4}$

$f(3) = 3^{2/3} = \sqrt[3]{9} =$ max

max at $x=3$

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find extrema of f(x). Solve graphically and analytically

Define $f1(x)=\frac{1}{\sqrt{4-x^2}} = (4-x^2)^{-1/2}$ Done

$f' = (-2x)\left(-\frac{1}{2}\right)(4-x^2)^{-3/2}$

$f' = \frac{x}{\sqrt{(4-x^2)^3}}$

$\lim_{x\to 2} \frac{1}{\sqrt{4-x^2}} = \infty$

stop?

candidate list — plug in f

$f'=0$ at $x=0$ is $y=\frac{1}{2}$

$f'=$ ∗ at ~~$x=2$~~ ~~$x=-2$~~

endpoints - none

domain $(-2,2)$

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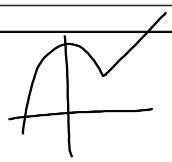
Define $f1(x)=\begin{cases} 5-2\cdot x^2, & x\le 1 \\ x+2, & x>1 \end{cases}$ Done

$f'(x) = \begin{cases} -4x & x<1 \\ 1 & x>1 \end{cases}$

lh deriv. $\neq$ rh deriv at $x=1$ (-4, 1)



candidate list

where

$f'=0$ at $x=0$

$f'=$ ∗ at $x=1$

what

$f(0)=5$ local max

$f(1)=3$ local min

Oct 18-9:00 AM

2.1 3.1 4.1 *Unsaved

Define $f1(x)=\ln\left(\left|\frac{x}{1+x^2}\right|\right)$ Done

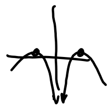
$$f' = \frac{1}{\left(\frac{x}{1+x^2}\right)} \bullet \frac{(1+x^2)1 - x\cdot 2x}{(1+x^2)^2}$$

1/99

$f'=0$ $x=1$ $x=-1$

$\cancel{f'=x \quad x=0}$

$x=0$ not in domain



$$f' = \frac{\cancel{1+x^2}}{x} \cdot \frac{1-x^2}{(1+x^2)^{\cancel{2}}} = \frac{1-x^2}{x(1+x^2)}$$

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